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## Introduction

Indian Agricultural Statistics Research Institute (IASRI) has been and continues to be a premier Institute of the Indian Council of Agricultural Research (ICAR) with glorious tradition of carrying out research, teaching and training in the areas of *Agricultural Statistics* and *Informatics*. Recognizing the importance of research and education in Agricultural Statistics way back in 1930, the then Imperial Council of Agricultural Research established a small *Statistical Section* to assist the State Departments of Agriculture and Animal Husbandry in planning and designing their experiments, analysis of experimental data, interpretation of results, and also rendering advice on the formulation of the technical programmes and examining the progress reports of the schemes funded by the Council. The activities of the Section increased rapidly with the appointment of Dr. PV Sukhatme as Statistician to the Council in 1940 and studies were initiated for developing objective and reliable methods for collecting yield statistics of principal food crops. The efficiency and practicability of these methods was demonstrated in different States for estimating crop yield. As a result, in the course of a few years, the method was extended practically to the entire country to cover all principal food and non-food crops. Research in sampling theory and training of field staff and statistical staff were the activities initiated in this period resulting in the re-organization of the Statistical Section into a *Statistical Branch* in 1945 with appropriate expansion in its strength. The designation of Statistician was changed to Statistical Advisor. The Statistical Branch was renamed as *Statistical Wing* in

1949. The Statistical Wing soon acquired International recognition as a centre for research and training in the field of Agricultural Statistics. During 1952 on the recommendations of two FAO experts, Dr. Frank Yates and Dr. DJ Finney, who visited the Council on the invitation of the Government of India, activities of the Statistical Wing were further expanded and diversified. Subsequently, in recognition of its important role as a training and research institution, the Statistical Wing was re-designated as the *Institute of Agricultural Research Statistics* (IARS) on 02 July 1959. In April 1970, the Institute was declared as a full-fledged Institute in the ICAR system and is since then headed by a Director. On 01 January 1978 the name of the Institute was changed to *Indian Agricultural Statistics Research Institute* (IASRI) emphasizing the role of 'Agricultural Statistics' as a full-fledged discipline by itself.

The Goal of the Institute is to conduct research, education and training in Agricultural Statistics and Computer Applications in Agriculture. The vision of the institute is to use the power of Statistics as a science blended judiciously with information communication technology to enhance the quality of agricultural research. To convert this vision into a reality, the Institute has set for itself a mission to undertake research, teaching and training in Agricultural Statistics and Computer Applications so that these efforts culminate into improved quality of agricultural research and also meet the challenges of agricultural research in newer

emerging areas. The functions and activities of the Institute have been re-defined from time to time in the past. The present main thrust of the Institute is to conduct basic, applied, adaptive, strategic and anticipatory research in Agricultural Statistics, to develop trained manpower and to disseminate knowledge and information produced so as to meet the methodological challenges of agricultural research in the country.

The Institute has made its presence felt in the National Agricultural Research System (NARS). The Institute is also becoming progressively a repository of information on agricultural research data and has taken a lead in the country in developing a data warehouse on agricultural research data. The Institute has established linkages with all NARS organisations for strengthening statistical computing. A National Agricultural Bioinformatics Grid is being planned with high performance computing facilities. The Institute also occupies a place of pride in the National Agricultural Statistics System (NASS) and has made several important contributions in strengthening NASS, which has a direct impact on the national policies. Some of the research activities and their impact are given in the sequel:

### **Research Achievements and Impact**

The Institute has made some outstanding and useful contributions to the research in Agricultural Statistics in the fields like Design of Experiments, Statistical Genetics, Forecasting Techniques, Statistical Modelling, Sample Surveys, Econometrics, Computer Applications in Agriculture, Software Development, etc. IASRI has conducted basic and original research on many topics of interest and has published number of papers in national and international journals of repute. IASRI has been providing and continues to provide support to the NARS by way of analyzing voluminous data using advanced and appropriate analytical techniques. IASRI has also been very actively pursuing advisory services that has enabled the Institute to enrich the quality of agricultural research in the NARS. Through its advisory, IASRI has made its presence visibly felt in NARS and now experimenters look to IASRI for designing experiments and analysis of experimental data.

The efficient designs like balanced incomplete block designs, group divisible and extended group divisible

designs, reinforced extended group divisible designs, square and rectangular lattice designs,  $\alpha$ -designs, reinforced  $\alpha$ -designs, augmented designs, designs for fitting response surfaces, etc. and advanced analytical techniques including contrast analysis, linear models with nested structures, experiments with mixtures methodology, mixed effects models, biplot, etc. have been adopted by the experimenters in NARS. The application of  $\alpha$ -designs and resolvable block designs has improved the precision of treatment comparisons in Crop Improvement programmes of Rapeseed and Mustard, Sorghum, etc. The analytical techniques for estimating/projecting the Energy Requirement in the Agricultural Sector has been exploited for the analysis of countrywide data. The analytical techniques for the analysis of data from the experiments conducted to study the post harvest storage behaviour of the perishable commodities like fruits and vegetables are being widely used in NARS. The Institute works in close collaboration with NARS organizations and many projects are being run at the Institute in collaboration with All India Co-ordinated Research Projects and ICAR Institutes. The analytical techniques based on mixed-effects models and biplot developed for the analysis of data generated from Farmers Participatory Trials for resource conservation agriculture are used by Rice-Wheat consortium for Indo-Gangetic plains for drawing statistically valid conclusions. Institute has developed linkages with the CGIAR organizations such as CIMMYT, IRRI and ICARDA. The status of experimentation is now changing and with the support provided in terms of suggesting efficient designs and analyzing the data using modern complicated statistical tools, the research publications of the agricultural scientists are finding a place in high impact factor international journals.

The methodology for General Crop Estimation Surveys (GCES), cost of cultivation studies, Integrated Sample Surveys (ISS) for livestock product estimation, fruits and vegetable survey, which are being adopted throughout the country are research efforts of IASRI. Methodology based on small area estimation technique for National Agricultural Insurance Scheme suggested by IASRI has been pilot tested in the country. A status paper on chronological development and present status of information support system for management of agriculture was prepared as a part of State of Indian Farmer: A Millennium Study of Ministry of Agriculture. The sample survey methodology for imported fertilizer



quality assessment, fish resources estimation, flower production estimation, area and production of horticultural crops estimation, etc. have been developed and passed on to the user agencies. Integrated methodology for estimation of multiple crop area of different crops in North Eastern Hilly Regions using Remote Sensing data has been developed. Sampling methodology for estimation of post harvest losses has been successfully adopted in AICRP on Post Harvest Technology for assessment of post harvest losses of crops/commodities.

The Institute has also made very significant contributions in developing the analytical techniques for the estimation of genetic parameters, models for pre-harvest forecasting of crop yields, models for forewarning of incidence of pests and diseases and econometrics and statistical modeling of biological phenomena using non-linear models, non-parametric regression, structural time series, neural network and machine learning approaches. The techniques developed have potential applications in long term projections of food grain production, aphid population, marine fish production, etc. The methodology developed for forecasting based on weather variables and agricultural inputs was used by Space Application Centre, Ahmedabad, to obtain the forecast of wheat yield at national level. Models developed for forewarning of aphids in mustard crop were used by National Research Centre for Rapeseed and Mustard to provide forewarning to farmers which enabled them to optimize plant protection measures and save resources on unnecessary sprays consecutively for three years. The modification in the procedure of estimation of genetic parameters has been suggested for incorporating the effect of unbalancedness, presence of outliers, aberrant observations and non-normality of data sets. Procedures for studying genotype  $\times$  environment interactions and QTL  $\times$  Environments have been developed and used for the analysis of data generated from crop improvement programmes. The research work on construction of selection indices and progeny testing and sire evaluation have been used for animal improvement programmes. The Institute has now initiated research in the newer emerging area of statistical genomics.

### **Achievements in Information Communication Technology**

The Institute has the capability of development of

Information Systems, Decision Support Systems and Expert Systems. Realizing the need of integration of databases to prepare a comprehensive knowledge warehouse that can provide desired information in time to the planners, decision-makers and developmental agencies, Integrated National Agricultural Resources Information System (INARIS) with the active support of 13 sister institutes as partners has been developed. The data warehouse comprises of 59 databases on agricultural technologies of different sectors of agriculture and related agricultural statistics at districts/state/national levels, population census including village level population data as well as tehsil level household assets and livestock census. Subject-wise data marts have been designed, multi-dimensional data cubes developed and published in the form of on-line decision support system. The Institute has also developed information systems for agricultural field experiments, animal experiments and long term fertilizer experiments conducted in NARS. Besides, a comprehensive Personnel Management Information System Network (PERMISnet) has been implemented for the ICAR for manpower planning, administrative decision making, and monitoring. For National Agricultural Technology Project, a Project Information and Management System Network (PIMSnet) was developed and implemented for concurrent monitoring and evaluation of 845 projects. This is being developed as a Project Information and Management System for all ICAR projects. A National Information System on Agricultural Education Network in India (NISAGENET) has been designed, developed and implemented so as to maintain and update the data regularly on parameters related to agricultural education in India. Online Management System for Post Graduate Education has been developed and implemented for PG School, IARI, New Delhi. Expert Systems on Wheat Crop, Maize Crop and Seed Spices have also been developed and implemented.

A milestone in the research programmes of the Institute was created when it started developing indigenous statistical software packages mainly for analysis of agricultural research and animal breeding data. Statistical packages for generation of experimental designs for various experimental situations, both unstructured and factorial structure of treatments, catalogues of designs, randomized layout of design and analysis of data were also developed. Statistical packages developed and widely being used in NARS are:

- Statistical Package for Agricultural Research (SPAR) 2.0
- Statistical Package for Block Designs (SPBD) 1.0
- Statistical Package for Factorial Experiments (SPFE) 1.0
- Statistical Package for Augmented Designs (SPAD) 1.0
- Software for Survey Data Analysis (SSDA) 1.0
- Statistical Package for Animal Breeding (SPAB) 2.1

A total of 320 Statistical packages have been sold out since their release, which includes 157 SPAR 2.0, 46 SPAD, 49 SPFE 1.0, 28 SPAB 2.0, 36 SPBD Release 1.0 and 04 SSDA 1.0, out of which 47 Statistical packages including 31 SPAR 2.0, 01 SPBD Release 1.0, 04 SPFE 1.0, 07 SPAD, 02 SSDA 1.0 and 02 SPAB 2.0 have been sold during the period under report.

The creation of Design Resources Server, an e-learning and e-advisory resource for the experimenters, has been another revolution in the growth of the Institute. The server provides a platform to popularize and disseminate research and also to further strengthen research in newer emerging areas in design of experiments among peers over the globe in general and among the agricultural scientists in particular so as to meet the emerging challenges of agricultural research. This server is hosted at [www.iasri.res.in/design](http://www.iasri.res.in/design).

### **Achievements in Human Resource Development**

The one of the thrust areas of the Institute is to develop trained manpower in the country in the disciplines of Agricultural Statistics and Computer Applications for meeting the challenges of Agricultural Research in the newer emerging areas. A humble beginning in the area of development of trained manpower was made in 1945 with the initiation of two regular certificate courses, one course of six months duration, called Junior Certificate Course (JCC) and the other course of one year duration called Senior Certificate Course (SCC). Besides, there was another course of one year duration known as Professional Statisticians' Certificate Course (PSCC) that was introduced to train professional statisticians. Subsequently, a Diploma course involving a research project of one year duration, in addition to PSCC consisting of one year course work in advanced statistics, was also introduced. These certificate courses helped in strengthening the linkages of the

Institute with the State Departments of Agriculture and Animal Husbandry. The certificate courses started in 1945 were discontinued by the Indian Council of Agricultural Research (ICAR) in 1985-86. However, during 1997, the Senior Certificate Course in Agricultural Statistics and Computing was revived. This course is now of six months duration and lays more emphasis on statistical computing using statistical softwares. The course is divided into two modules viz. (i) Statistical Methods and Official Agricultural Statistics, and (ii) Use of Computers in Agricultural Research, of three months duration each. 80 participants have completed both modules, 31 have completed module-I and 21 have completed module-II since 1997.

The year 1964 witnessed tremendous changes in the activities of the Institute when an Memorandum of Understanding (MOU) was signed with Indian Agricultural Research Institute (IARI), New Delhi to start new degree courses leading to M.Sc. and Ph.D. in Agricultural Statistics. In 1981, a two years Diploma Course in Advanced Computer Programming was introduced. On the recommendations of UNDP, this course was soon discontinued and in 1985 another new course leading to an M.Sc. degree in Computer Applications in Agriculture was initiated in collaboration with IARI, New Delhi. This course was re-designated as M.Sc. degree in Computer Application during 1993-94. The Institute has so far produced 176 Ph.D. and 298 M.Sc. students in Agricultural Statistics and 93 M.Sc. students in Computer Application. A new degree course M.Sc. in Agricultural Bioinformatics would begin from academic year 2011-12 in collaboration with IARI, New Delhi; NRCPB, New Delhi and NBPGR, New Delhi.

The functioning of the Institute as a Centre of Advanced Studies in Agricultural Statistics and Computer Application during October 1983 to March 1992 under the aegis of United Nations Development Programme was another landmark in the history of the Institute. The purpose of this programme was to develop the Institute as a centre of excellence with adequate infrastructure and facilities to undertake advanced training programmes and to carry out research in various emerging areas of Agricultural Statistics and Computer Application. Under this programme, a number of illustrious statisticians and computer scientists from abroad visited the Institute with a view to interact with the scientists, giving seminars/ lectures



and suggesting gaps in the research programmes of the Institute. Under the programme some scientists of the Institute received training for capacity building from abroad. Another singular development in the growth of the Institute was the Centre of Advanced Studies Programme in Agricultural Statistics and Computer Application established during the VIII Five Year Plan in 1995. Under this programme the Institute organizes training programmes on various topics of current interest for the benefit of scientists of NARS. These training programmes cover specialized topics of current interest in statistics and agricultural sciences. During the period under report the Centre of Advanced Studies (CAS) is renamed as Centre of Advanced Faculty Training (CAFT). So far 45 training programmes have been organised under the aegis of CAS/CAFT. In all a total of 805 participants have been benefited.

There is yet another form of training courses, which are tailor made courses and are demand driven. The coverage in these courses is need based and the courses are organized for specific organizations from where the demand is received. The Institute has conducted such programmes for Indian Council of Forestry Research, Indian Statistical Service probationers and senior officers of Central Statistical Organization and many other organizations. The Institute has also conducted several international training programmes on request from FAO, particularly for African, Asian and Latin American countries. The Institute has broadened the horizon of capacity building by opening its doors to the agro-based private sector. One such training programme was organized for research personnel of E.I. DuPont Pvt. Ltd. The Institute has also conducted training programmes for the scientists/research personnel of CGIAR organizations such as ICARDA and Rice-Wheat Consortium for Indo-Gangetic plains. A number of research workers from the Institute have served as consultants and advisors in Asian, African and Latin American countries. Also, a number of statisticians and students of the Institute are at present occupying high positions in universities and other academic and research institutions of USA, Canada and other countries.

### **Infrastructural Developments**

As the activities of the Institute started expanding in all directions, the infrastructure facilities also started expanding. Two more buildings 'Computer Centre' and 'Training-cum-Administrative Block' were constructed

in the campus of the Institute in the years 1976 and 1991, respectively. There are three well furnished hostels, viz. Panse Hostel-cum-Guest House, Sukhatme Hostel and International Training Hostel to cater the residential requirements of the trainees and students. An important landmark in the development of the Institute was the installation of an IBM 1620 Model-II Electronic Computer in 1964. A third generation computer Burroughs B-4700 system was installed in March 1977. The Burroughs B-4700 system was replaced in 1991 by a Super Mini COSMOS-486 LAN Server with more than hundred nodes consisting of PC/AT's, PC/XT's and dumb terminals all in a LAN environment. Later, COSMOS-486 LAN Server was replaced by a PENTIUM-90 LAN Server having state-of-art technology with UNIX operating system. Computer laboratories equipped with PCs, terminals and printers, etc. had been set up in each of the six Scientific Divisions as well as in the Administrative Wings of the Institute.

For undertaking research in the newer emerging areas, a laboratory on Remote Sensing (RS) and Geographic Information System (GIS) was created in the Institute. The laboratory was equipped with latest state-of-art technologies like computer hardware and peripherals, Global Positioning System (GPS), softwares like ERMMapper, PCARC/INFO, Microstation 95, Geomedia Professional, ARC/INFO Workstation, ARC-GIS and ERDAS Imagine with the funds received through two AP Cess Fund projects. This computing facility has further been strengthened with the procurement of ARC-GIS software under NATP programme.

An Agricultural Bioinformatics Lab (ABL) fully equipped with software and hardware has been created to study crop and animal biology with the latest statistical and computation tools. A training lab for Strengthening Statistical Computing for NARS has also been established.

Keeping pace with the emerging technologies in the area of Information Technology (IT), from the year 1998 onwards the computing infrastructure have been constantly upgraded/replaced with newer platforms and versions. The computing environment in the Institute has latest computing and audio visual equipments i.e. High Performance Computing having 144 cores Intel HPC cluster, rack mount & redundant SMPS servers, workstations, desktops, laptops, netbooks, documents printing & scanning, DVD duplicator, visualiser and

wireless multimedia projectors etc. The Institute is also well equipped with redundant power source and 12 mbps bandwidth fiber optics backbone wired and wireless networking campus.

The networking services at IASRI have steadily been strengthened. Currently the internet services are being provided to the scientists, technical & administrative staff and students through Firewall, Content filtering, E-mail filtering, Antivirus, Application control and Data Leak Prevention (DPL). The Institute domain service like Primary and Secondary DNS, Domain (iasri.res.in) Website (<http://www.iasri.res.in>), Live E-mail services, more than 462 network nodes and number of various Online Information Systems are being developed and maintained by the Institute's officials.

As per requirements, scientists and officials of the Institute have been provided with workstations/desktops/notebooks, printers and peripherals and also software packages that are needed for application development, statistical data analysis, network securities and office automation. There are various labs at the Institute for dedicated services like ARIS lab for Training, Statistical computing lab, Stat lab for Statistical analysis, Student lab and Centre for Advanced Study lab. Some of the important softwares that are available are SAS 9.2, JMP 8.0, JMP Genomics 4.0, SAS BI Server 4.2, SPSS, SYSTAT, GENSTAT, Data warehouse software – Cognos, SPSS clementine, MS Office 2007, MS Visual Studio.net, MS-SQL Server,

Oracle, Macro-Media, E-views, STATISTICA Neural Networks, Gauss Software, Minitab 14, Maple 9.5, Matlab, Web Statistica, Lingo Super, ArcGIS etc.

### Organisational Set-up

The Institute is having six Divisions, two Units and three Cells to undertake research, training, consultancy, documentation and dissemination of scientific output.

### Divisions

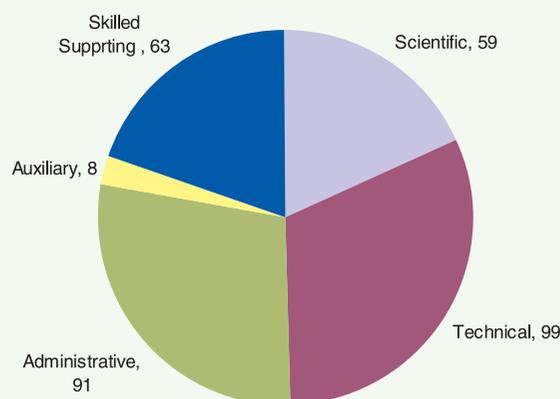
- Design of Experiments
- Biometrics
- Forecasting Techniques
- Sample Survey
- Econometrics
- Computer Applications

The Council vide Office Order No.5(9)/2010-IA-II(AE) dated 02 August 2010 has made following changes in the Divisions at IASRI w.e.f. 02 August 2010.

- The Division of Biometrics is renamed as Division of Biometrics and Statistical Modelling.
- The mandate and activities of Division of Forecasting Techniques and Division of Econometrics are merged to form Division of Forecasting and Econometrics Techniques.
- A new centre namely Centre for Agricultural Bio-informatics [CABin] has been created with the status of a Division at IASRI, New Delhi.

### Staff Position (as on 31 March 2011)

Manpower	No. of posts sanctioned	No. of posts filled
Director	1	1
Scientific	130	58
Technical	219	99
Administrative	84	91
Auxiliary	14	8
Skilled Supporting	80	63
<b>Total</b>	<b>528</b>	<b>320</b>



Staff Strength in Position as on 31 March 2011



The Council has also accorded approval for re-designing the post of the Head of Division of Econometrics and filling as Head, Centre for Agricultural Bio-informatics.

#### Now the Six Divisions at the Institute are

1. Design of Experiments
2. Biometrics and Statistical Modelling
3. Forecasting and Econometrics Techniques
4. Sample Surveys
5. Computer Applications
6. Centre for Agricultural Bio-informatics [CABin]

#### Units

- Research Co-ordination and Management Unit (RCMU)
- Institute Technology Management Unit (ITMU)

#### Cells

- Training Administration Cell (TAC)
- Consultancy Processing Cell (CPC)
- Planning, Monitoring and Evaluation (PME) Cell

#### Financial Statement

The Standing Finance Committee had approved the XI Plan Budget of the Institute. The total outlay of Rs. 1200 lakhs was sanctioned under the XI Plan budget of the Institute.

Through regular monitoring, the Institute was able to ensure optimal utilization of funds available in the budget. The actual utilization of the budget both under plan and non-plan is furnished in the sequel.

#### Budget Allocation vis-à-vis Utilization (2010–11)

(Rupees in Lakhs)

Head of Account	Allocation		Expenditure	
	Plan	Non-Plan	Plan	Non-Plan
Pay & Allowances	0.00	1981.08	0.00	1838.69
TA	6.50	4.00	6.49	4.00
OTA	0.00	1.00	0.00	0.53
HRD/Fellowship	1.50	33.50	1.31	31.87
Contingencies	80.00	368.56	79.10	332.91
Equipments	5.00	2.00	4.99	1.86
Furniture	0.00	0.00	0.00	0.00
Works	27.00	34.71	26.93	34.58
Library	30.00	0.00	29.85	0.00
<b>Total</b>	<b>150.00</b>	<b>2424.85</b>	<b>148.67</b>	<b>2244.44</b>



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Please Select Crop

--Select your crop--

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## Helping Farmers Worldwide



EXPSS is a web based Expert System developed on Seed Spices. It provides the complete information about Seed Spices Production Management in the country. The System covers altogether 10 Seed Spices namely Ajwain, Anise, Caraway, Cumin, Celery, Coriander, Dil, Fennel, Fenugreek, Nigella.

It advises farmers of Seed Spice on varieties on the basis of area, cultural and climatic conditions and other characteristics of farmer's interest. It also suggests the appropriate cultural practices like field preparation, fertilizer


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## Partner Institute

IASRI  
ICAR

## Maize Technology

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## Queries &amp; Solutions

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The Expert System for Maize Crop emulates the interaction a user might have with a human expert to solve a problem. It is meant to enhance the efficiency of farmers or Agricultural Extension personnel for maize crop management and to increase the crop yield. It determines the best strategy for irrigating, applying fertilizer and insecticides. Presently, it has four subsystems: Variety Selection, Cultural Practices, Disease Diagnosis, Insect Identification, and Post Harvest Technology. The Variety Selection subsystem advises location specific varieties and Cultural Practices advises on the aspects of irrigating, application of fertilizers and insecticides. Disease Diagnosis and Insect Identification subsystems help the stake-holders to diagnose the disease and to identify insects affecting the maize crop and suggest preventive and control measures. Post Harvest Technology subsystem deals with storage and processing of maize for developing value added products.

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